WATER RESOURCES REVIEW for

JANUARY 1973

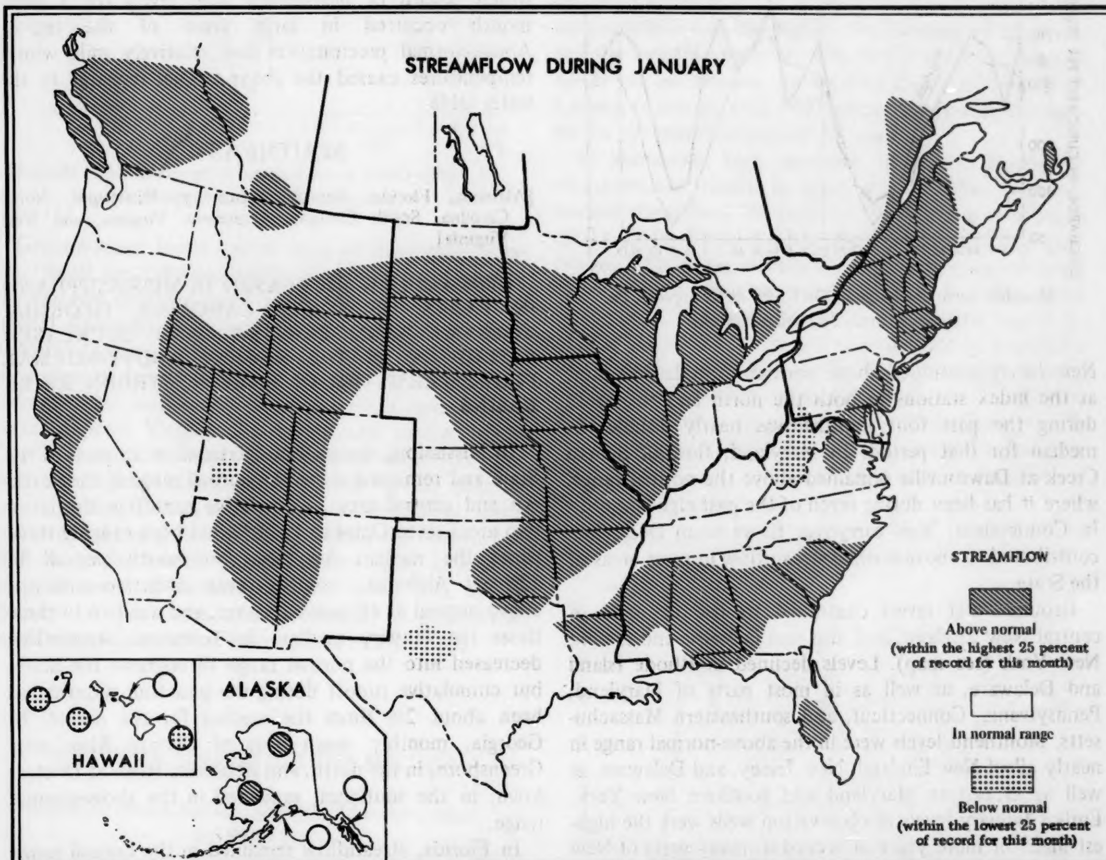
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

STREAMFLOW AND GROUND—WATER CONDITIONS

Streamflow increased in much of conterminous United States and decreased in Alaska, most of Hawaii, in parts of several eastern and western States, and in southern Canada. Flooding occurred in some coastal basins of California and in northern Illinois.

Above-normal streamflow conditions persisted in roughly one-half of the United States, but the area of above-normal flows became larger in the Midcontinent from December to January and lessened in the Northeastern and Southeastern regions. Higher-than-normal flows also continued in southeastern Quebec, and a new large area of above-normal flows occurred in southwestern Canada. New maximum monthly or daily mean discharges for January were observed at many index stream-gaging stations.



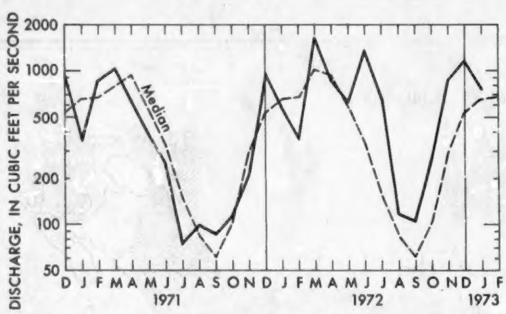
NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

STREAMFLOW WAS ABOVE NORMAL IN MOST OF THE REGION, AND INCREASED SLIGHTLY IN EASTERN QUEBEC, SOUTHERN MAINE, AND THE CENTRAL NEW ENGLAND STATES, BUT DECREASED IN ALL OTHER AREAS.

In Quebec, monthly mean discharge of Outardes River (drainage area, 7,230 square miles) was 9,520 cfs, highest for January since records began in September 1922. Near-record January flows occurred in parts of Rhode Island, Massachusetts, and Vermont, largely the result of favorable antecedent conditions. Cumulative runoff at index stations in those States for the October through January period was roughly two to three times the median.

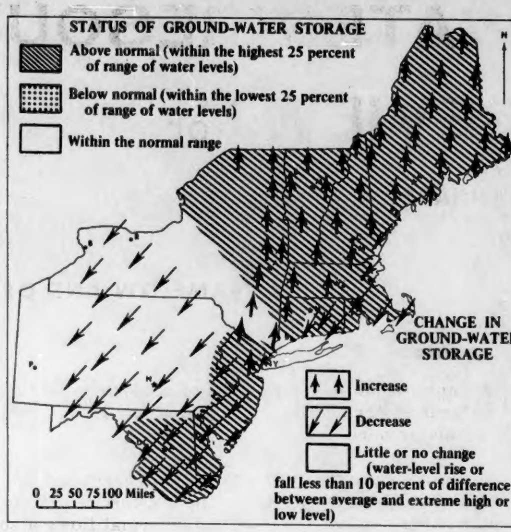
In Pennsylvania, flow of Oil Creek at Rouseville decreased but remained above the median for the ninth consecutive month (see graph). Streamflow throughout



Monthly mean discharge of Oil Creek at Rouseville, Pa. (Drainage area, 300 square miles.)

New Jersey continued above normal. Cumulative runoff at the index stations in both the north and the south during the past four months was nearly double the median for that period. In Maryland, flow of Seneca Creek at Dawsonville remained above the normal range, where it has been during seven of the past eight months. In Connecticut, high carryover flows from December contributed to above-normal streamflow in most areas of the State.

Ground-water levels continued to rise in most of central New England, and also rose in Maine and eastern New York (see map). Levels declined in Rhode Island and Delaware, as well as in most parts of Maryland, Pennsylvania, Connecticut, and southeastern Massachusetts. Monthend levels were in the above-normal range in nearly all of New England, New Jersey, and Delaware, as well as in eastern Maryland and southern New York. End-of-January levels in observation wells were the highest in 25 or more years of record in many parts of New England. January was the third consecutive month in



Map above shows ground-water storage near end of December and change in ground-water storage from end of December to end of January.

which record or near-record high levels for a given month occurred in large areas of the region. Above-normal precipitation and relatively mild winter temperatures caused the above-normal recharge to the water table.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

STREAMFLOW INCREASED IN MISSISSIPPI AND IN PARTS OF SOUTH CAROLINA, GEORGIA, ALABAMA, AND FLORIDA; AND DECREASED ELSEWHERE IN THE REGION. ABOVE-NORMAL FLOWS PERSISTED IN SOME SOUTHERN RIVER BASINS.

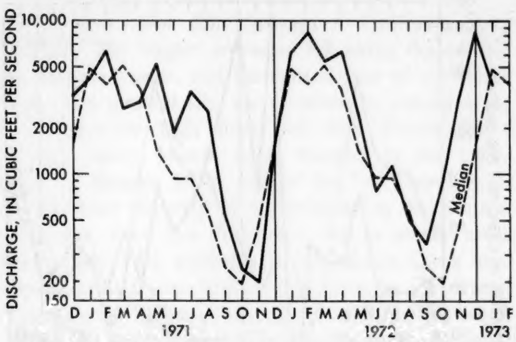
In Mississippi, streamflow increased in all parts of the State and remained above the normal range in the northern and central areas. Cumulative runoff in the latter two areas since October 1, 1972, has been roughly three times the median for that four-month period. In adjacent Alabama, monthly mean discharge remained above normal at all index stations, and was two to three times the January median. In Tennessee, streamflow decreased into the normal range throughout the State, but cumulative runoff during the past four months has been about 2½ times the median for the period. In Georgia, monthly mean flow of Oconee River near Greensboro, in the north, and Altamaha River at Doctortown, in the southeast, remained in the above-normal range.

In Florida, streamflow remained in the normal range in the peninsular part of the State and was above normal

in the northwest, southwest, and in the Everglades area. The flow of Silver Springs increased 13 cfs, to 700 cfs; 86 percent of normal. Flow southward through the Tamiami Canal outlets, 40-mile bend to Monroe, increased 73 cfs, to 104 cfs; 251 percent of normal. The flow of Miami Canal at Miami increased 33 cfs, to 133 cfs; 41 percent of normal.

In West Virginia, streamflow decreased sharply during the month and was below the normal range on Greenbrier River at Alderson, in the southeast. In the northeast, monthly mean flow of Potomac River at Paw Paw decreased from 12,487 cfs in December to 3,201 cfs in January, and was in the normal range for the first month since September 1972.

In Kentucky, flow of Green River at Munfordville decreased to near median level (see graph).



Monthly mean discharge of Green River at Munfordville, Ky. (Drainage area, 1,673 square miles.)

Ground-water levels rose in most of the region; however, levels generally declined in West Virginia (except in the extreme southern part) and in the shallow aquifer in central Kentucky. Monthend levels were above average in North Carolina, Alabama, and most of West Virginia; were near or below average in Florida; and were below average in the southwestern quarter and extreme eastern parts of West Virginia. In eastern and central North Carolina, monthend water levels in some wells were at or near the highest end-of-January levels of the past 35 years. In the Jackson area of central Mississippi, levels changed only slightly in the Cockfield Formation but declined in the heavily pumped Sparta Sand. In heavily pumped areas of eastern Georgia, levels rose in the vicinity of Brunswick and Savannah. At Brunswick, levels were about 12 feet below those of a year ago.

WESTERN GREAT LAKES REGION

[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

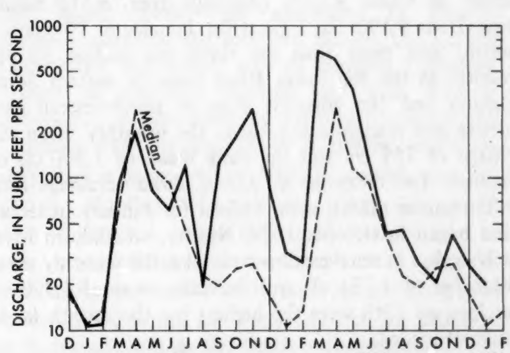
STREAMFLOW GENERALLY INCREASED AND WAS ABOVE THE NORMAL RANGE IN THE CENTRAL AND SOUTHWESTERN PARTS OF THE REGION. FLOWS DECREASED IN OHIO, INDIANA, AND MUCH OF MINNESOTA, AND IN ONTARIO NORTH OF LAKES HURON AND SUPERIOR. ICE JAMS CAUSED FLOODING IN NORTHERN ILLINOIS.

Streamflow increased and was above the normal range in Illinois, Wisconsin, Michigan, and in southern Minnesota, largely the result of snowmelt runoff caused by warm weather during the first half of the month. Moderate rains fell in some areas.

In northern Illinois, ice-jam flooding caused considerable damage to property on the flood plains of several streams. Monthly mean discharge at index streamflow stations in northern and central Illinois remained in the above-normal range for the fifth consecutive month. In northwestern Wisconsin, monthly mean discharge of Jump River at Sheldon (drainage area, 574 square miles) increased to 409 cfs, highest for January since records began in 1915.

In Michigan, record-high flows occurred in the Lower Peninsula, where the monthly mean discharge of 1,696 cfs on Muskegon River at Evart (drainage area, 1,450 square miles) was the highest for January in 40 years, and the monthly mean of 710 cfs and the daily mean of 2,400 cfs on January 1st on Red Cedar River at East Lansing (drainage area, 355 square miles) were the highest for the month in at least 35 years.

In Minnesota, high carryover flow from December, plus snowmelt runoff in some areas, resulted in above-normal streamflow throughout the southern two-thirds of the State. Flow of Crow River at Rockford, in east-central Minnesota, remained in the above-normal range for the 28th consecutive month. The monthly mean discharge of Minnesota River near Jordan (drainage area, 16,200 square miles), in southern Minnesota, was above the normal range and roughly four times the January median. In the western part of the State, flow of Buffalo River near Dilworth, tributary to Red River of the North, remained in the above-normal range for the third consecutive month and was nearly double the January median (see graph).



Monthly mean discharge of Buffalo River near Dilworth, Minn. (Drainage area, 1,040 square miles.)

Ground-water levels rose in water-table wells in Michigan's Lower Peninsula, in northern Illinois, and in Wisconsin. Levels declined in Minnesota and Ohio. Monthend levels were above average in many parts of the region, including Ohio and much of Wisconsin, and reached highest end-of-January levels in more than 20 years in parts of Minnesota and Michigan's Lower Peninsula. In the heavily pumped artesian aquifers in the Minneapolis-St. Paul, Minn., area, levels continued to rise but remained below average. In the Milwaukee, Wis., area, levels continued to decline in the heavily pumped, deep sandstone aquifers.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

STREAMFLOW GENERALLY INCREASED AND WAS ABOVE THE NORMAL RANGE FROM NORTH DAKOTA TO NORTHERN LOUISIANA, AS A RESULT OF ABOVE-NORMAL TEMPERATURES AND SNOWMELT IN THE NORTH, AND RAINS IN THE SOUTH, AUGMENTED BY HIGH CARRYOVER FLOW FROM DECEMBER IN SOME BASINS. RECORD-BREAKING JANUARY FLOWS OCCURRED IN NORTH DAKOTA, SOUTH DAKOTA, NEBRASKA, AND IOWA.

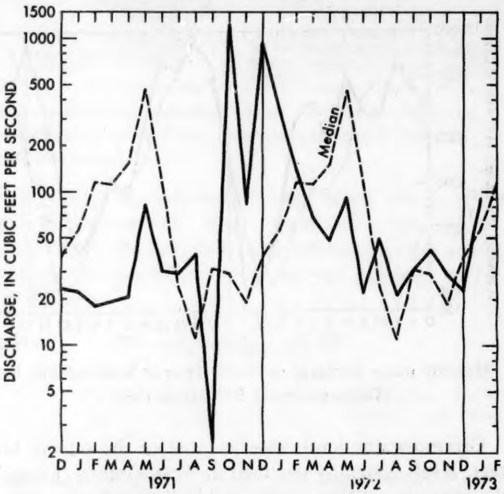
In North Dakota, an unusually long period of above-normal temperatures during the latter half of the month resulted in a nearly complete snowmelt in the west and south. The resultant runoff established new maximum monthly flows on most of the western tributaries to Missouri River. For example, the monthly mean discharge of 193 cfs on Cannonball River at Breien (drainage area, 4,100 square miles) and the daily mean of 640 cfs on January 24th were the highest for January in record that began in 1934. By comparison, the previous maximum monthly and daily means were 26.5 cfs and 75 cfs, respectively, and the new January maximum monthly mean was nearly 50 times the median for the month.

In eastern Iowa, the monthly mean discharge of Cedar River at Cedar Rapids (drainage area, 6,510 square miles) was 9,192 cfs, highest for January in 70 years of record and more than ten times the median for the month. In the Big Sioux River basin of eastern South Dakota and the adjacent areas of southwestern Minnesota and northwestern Iowa, the monthly mean discharge of 755 cfs and the daily mean of 1,900 cfs on January 1st, observed at Akron, Iowa (drainage area, 9,030 square miles), were highest for January in record that began in October 1928. Nearby, on Elkhorn River at Waterloo in northeastern Nebraska, the monthly mean discharge of 1,331 cfs and the daily mean of 4,990 cfs on January 19th were the highest for the month in 44 years of record.

The first flow of the 1973 water year occurred in January in Bad River near Ft. Pierre, South Dakota, as a result of snowmelt runoff.

Streamflow increased during January in southwestern Oklahoma and was normal for the first time in six months. Flow at the index station, Washita River near Durwood, in south-central Oklahoma, increased appreciably during the month; and the monthly mean at that site was almost three times the January median.

In Texas, streamflow was in the normal range except in North Concho River near Carlsbad, where no flow has occurred since October 25, 1972. Flow of North Bosque River near Clifton, in north-central Texas, increased seasonally, and the monthly mean was 164 percent of the January median (see graph). Flow of Comal River at New Braunfels was 322 cfs on January 24th.



Monthly mean discharge of North Bosque River near Clifton, Texas (Drainage area, 972 square miles.)

The level of Lake Winnipeg at Gimli, Manitoba, averaged 714.00 feet above mean sea level, 1.05 feet above the long-term mean for the month.

Ground-water levels rose seasonally in most of the region. In east-central Louisiana, levels dropped slightly in the terrace deposits of Pleistocene age. Monthend levels were above average in Kansas, Nebraska, and Iowa except in heavily pumped areas; levels were near average in western North Dakota. In the rice-growing area of east-central Arkansas, levels remained about the same in the shallow aquifer (Quaternary deposits) and rose in the deep aquifer (Sparta Sand) but were lowest of record for January in the deep aquifer, 4 feet below the level of a year ago. In central and southern Arkansas, levels declined in the industrial aquifer (Sparta Sand) at Pine Bluff and El Dorado. In Texas, levels rose in the Edwards Limestone at Austin and in the Evangeline aquifer at Houston; and declined in the Edwards

Limestone at San Antonio and in the bolson deposits at El Paso. Monthend levels were above average at Austin and San Antonio, but below average at Houston and El Paso.

WEST

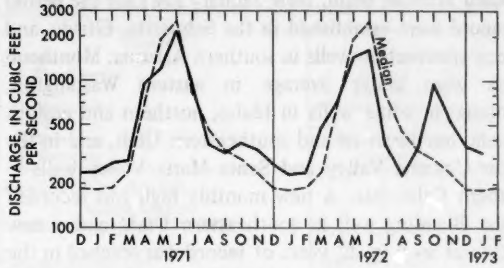
[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

STREAMFLOW GENERALLY DECREASED IN NORTHERN AND EAST-CENTRAL SECTIONS OF THE REGION AND INCREASED THROUGHOUT CALIFORNIA AND IN PARTS OF ALL OTHER PROVINCES AND STATES. FLOODING OCCURRED IN COASTAL AREAS OF CALIFORNIA.

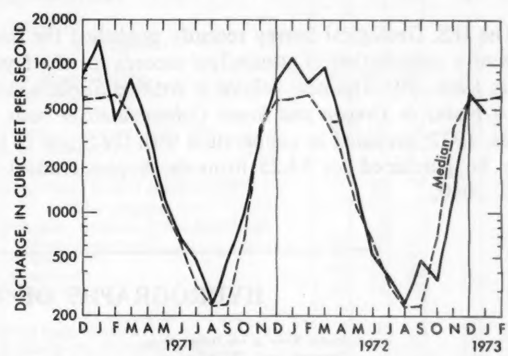
Very heavy rains fell throughout California near midmonth. The largest amounts fell along the central coast, southern coast, and the central part of the Sierra Nevada. The greatest damage occurred in coastal areas where extremely high tides and high stream stages coincided. Many homes were flooded in the lower reaches of Russian River and in the San Luis Obispo area. Mudslides occurred in the Bolinas Bay and Stinson Beach areas, near San Francisco, and in several areas farther south. Peak discharge of Salispuedes Creek near Lompoc, tributary to Santa Ynez River in the coastal area near Santa Barbara, was highest since records began in 1951. The water level in Gibraltar Reservoir, on Santa Ynez River near Santa Barbara, rose 22 feet on January 18th—the greatest rise for a single day since reservoir operation began in 1920. In the north-central part of the State, monthly mean discharge of Sacramento River at Verona (drainage area, 21,257 square miles) was 80,020 cfs, highest for January since records began in 1930. Also, in the same area, flow of North Fork American River at North Fork Dam increased sharply into the above-normal range.

In Idaho, flow of Snake River near Heise remained above the normal range, where it has been during 25 of the past 27 months. In Wyoming, streamflow was above normal throughout the State; flow of North Platte River above Seminoe Reservoir, near Sinclair, has been in the above-normal range since October 1972. In Colorado, high carryover flows from December contributed to the above-normal flows of Roaring Fork River at Glenwood Springs and Animas River at Durango on the western slope of the Continental Divide. The monthly mean discharge of 328 cfs at Durango was highest for January in 72 years of record and above the median for the fifth consecutive month (see graph).

In southern Montana, flow of Yellowstone River at Corwin Springs remained above the normal range for the eighth consecutive month; and in the north, flow of Marias River near Shelby increased into the above-normal range as a result of snowmelt runoff. In Utah, streamflow remained above normal except in the southwest. Level of Great Salt Lake rose 0.30 foot during the month (to 4,199.05 feet above mean sea level) and was 0.70 foot higher than one year ago. In Washington, streamflow was within the normal range in all parts of the State. Flow of Chehalis River near Grand Mound, in the west, decreased and was slightly below the median (see graph).



Monthly mean discharge of Animas River at Durango, Colo. (Drainage area, 692 square miles.)



Monthly mean discharge of Chehalis River near Grand Mound, Wash. (Drainage area, 895 square miles.)

Ground-water levels fell in Idaho, Montana, North Dakota, the Puget Sound area of Washington, central Nevada, and in heavily pumped areas of California. Subnormal precipitation in January in the Pacific Northwest adversely affected water levels to some extent. Water levels rose seasonally in western Washington, northern and southern Nevada, central and southern Utah, the coastal area of southern California, and most of southern Arizona and New Mexico. Above-normal precipitation in the San Francisco and Los Angeles areas probably aided in bringing about the January rises in ground-water levels in coastal, southern California. Monthend levels were below average in western Washington, and in the heavily pumped areas of Nevada, central Utah, and in the southern parts of California, Arizona, and New Mexico. New January lows were established in the Las Vegas and Truckee Meadows areas in Nevada and in the Dayton observation well in the water-table aquifer in the southern part of the

Roswell artesian basin. New January lows for the period of record were established in the Sahuarita, Elfrida, and Wilcox observation wells in southern Arizona. Monthend levels were above average in eastern Washington, Montana, in some wells in Idaho, northern and eastern Nevada, northeastern and southeastern Utah, and in the Upper Cuyama Valley and Santa Maria Valley wells in southern California. A new monthly high was recorded in the Blanding well in southeastern Utah, and a new maximum level in 22 years of record was reached in the Safford Valley key well in southeastern Arizona.

ALASKA

Streamflow declined seasonally and was in the normal range in southern and southeastern coastal areas of the State. As a result of carryover of high fall runoff, and warm temperatures through December, flow in Little Susitna River and Chena River basins, in south-central and central Alaska, respectively, remained in the above-normal range.

Ground-water levels in the Anchorage area fell 0.5 to 1.5 feet; however, levels were well above their usual average for this time of year.

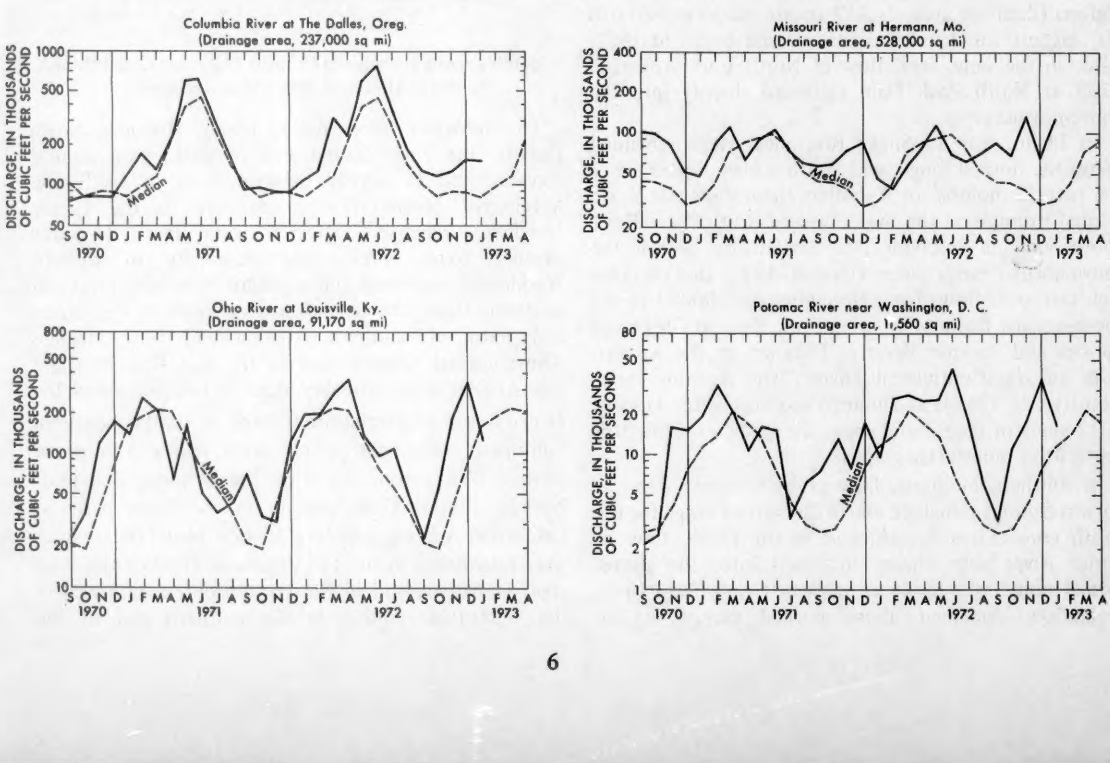
HAWAII

Streamflow continued to decline and remained below the normal range in most areas of the State. Flow at the index station on Kalihi Stream near Honolulu (drainage area, 2.61 square miles) was in the below-normal range for the eighth consecutive month. The monthly mean discharge of 0.62 cfs, and the daily mean of 0.30 cfs from January 22d to 31st, were the lowest since records began at this site in September 1913.

NEW REPORT ON STREAM DISCHARGES IN NORTHWESTERN UNITED STATES

The U.S. Geological Survey recently published the first volume of the new 37-volume series of reports that will present a compilation of streamflow records for the 5-year period, October 1965 through September 1970 (water years 1966–70). The new volume is entitled *Surface water supply of the United States, 1966–70, Part 14, Pacific slope basins in Oregon and lower Columbia River basin: U.S. Geological Survey Water-Supply Paper 2135*, 1,036 pages, 1972; prepared in cooperation with the States of Oregon and Washington and with other agencies. The report may be purchased for $4.25 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

HYDROGRAPHS OF FOUR MAJOR RIVERS



USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF JANUARY 1973

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F–Flood control I–Irrigation M–Municipal P–Power R–Recreation W–Industrial	End of Dec. 1972	End of Jan. 1973	End of Jan. 1972	Average for end of Jan.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	68	66	46	54	223,400 (a)
QUEBEC					
Gouin (P)	64	59	40	61	6,487,000 ac-ft
Allard (P)	95	83	46	42	280,600 ac-ft
MAINE					
Seven reservoir systems (MP)	63	60	26	46	179,300 mcf
NEW HAMPSHIRE					
Lake Winnipesaukee (PR)	80	61	54	55	7,200 mcf
Lake Francis (FPR)	72	59	33	50	4,326 mcf
First Connecticut Lake (P)	65	43	22	36	3,330 mcf
VERMONT					
Somerset (P)	73	65	71	58	2,500 mcf
Harriman (P)	60	51	45	47	5,060 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	78	79	78	70	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	67	60	56	44	34,270 mcf
Indian Lake (FMP)	69	48	63	53	4,500 mcf
New York City reservoir system (MW)	96	96	87	....	547,500 mg
NEW JERSEY					
Wanaque (M)	101	101	93	74	27,730 mg
PENNSYLVANIA					
Wallenpaupack (P)	75	58	76	49	6,875 mcf
Pymatuning (FMR)	88	77	78	83	8,191 mcf
MARYLAND					
Baltimore municipal system (M)	101	102	100	83	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	87	90	84	77	12,580 mcf
High Rock Lake (P)	94	96	77	67	10,230 mcf
Narrows (Badin Lake) (P)	100	97	95	96	5,616 mcf
SOUTH CAROLINA					
Lake Murray (P)	81	80	84	61	70,300 mcf
Lakes Marion and Moultrie (P)	89	88	92	65	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	66	70	69	54	75,360 mcf
GEORGIA					
Burton (PR)	80	81	82	54	104,000 ac-ft
Lake Sidney Lanier (FMPR)	51	59	63	51	1,686,000 ac-ft
Sinclair (MPR)	97	95	94	77	214,000 ac-ft
ALABAMA					
Lake Martin (P)	77	83	97	66	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	45	36	48	28	1,156,000 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	54	46	50	29	1,452,000 cfsd
Douglas Lake (FPR)	20	13	17	12	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	49	49	58	40	512,200 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	60	53	56	35	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	77	52	55	40	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	71	56	48	32	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	22	19	25	20	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	92	90	86	....	22,640,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	80	80	88	71	1,948,000 ac-ft
OKLAHOMA					
Keystone (FPR)	95	106	86	86	661,000 ac-ft
Lake O' The Cherokees (FPR)	94	109	86	76	1,492,000 ac-ft
Tenkiller Ferry (FPR)	103	112	99	85	628,200 ac-ft
Lake Altus (FIMR)	9	12	21	49	134,500 ac-ft
Eufaula (FPR)	97	103	91	79	2,378,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	96	95	95	86	2,722,000 ac-ft
TEXAS					
Possum Kingdom (IMPRW)	91	90	94	76	724,500 ac-ft
Buchanan (IMPW)	77	73	96	76	955,200 ac-ft
Bridgeport (IMW)	54	52	62	59	270,900 ac-ft
Eagle Mountain (IMW)	90	92	97	84	182,700 ac-ft
Medina Lake (I)	95	94	99	46	254,000 ac-ft
Lake Travis (FIMPRW)	93	99	96	78	1,144,000 ac-ft
Lake Kemp (IMW)	42	43	28	52	461,800 ac-ft
THE WEST					
ALBERTA					
Spray (P)	68	67	45	43	210,000 ac-ft
Lake Minnewanka (P)	80	66	53	52	199,700 ac-ft
St. Mary (I)	70	70	72	62	320,800 ac-ft
WASHINGTON					
Franklin D. Roosevelt Lake (IP)	98	94	94	77	5,232,000 ac-ft
Lake Chelan (PR)	51	36	29	44	676,100 ac-ft
IDAHO--WYOMING					
Upper Snake River (7 reservoirs) (IMP)	73	73	76	68	4,282,000 ac-ft
WYOMING					
Pathfinder, Seminoe, Alcova, Kortes, and Glendo Reservoirs (I)	63	65	71	34	3,016,000 ac-ft
Buffalo Bill (IP)	75	67	66	65	421,300 ac-ft
Boysen (FIP)	73	67	80	68	802,000 ac-ft
Keyhole (F)	83	84	78	32	199,900 ac-ft
COLORADO					
John Martin (FIR)	2	4	5	18	364,400 ac-ft
Colorado–Big Thompson project (I)	72	72	75	53	722,600 ac-ft
Taylor Park (IR)	35	36	63	55	106,000 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Navajo, and Blue Mesa Reservoirs (IFPR)	55	53	54	....	31,276,500 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	80	78	78	54	1,421,000 ac-ft
CALIFORNIA					
Hetch Hetchy (MP)	34	29	27	30	360,400 ac-ft
Lake Almanor (P)	67	66	62	44	1,036,000 ac-ft
Shasta Lake (FIPR)	76	76	78	70	4,377,000 ac-ft
Millerton Lake (FI)	62	78	63	62	503,200 ac-ft
Pine Flat (FI)	32	38	45	50	1,014,000 ac-ft
Isabella (FIR)	10	12	22	23	551,800 ac-ft
Folsom (FIP)	64	60	60	51	1,000,000 ac-ft
Lake Berryessa (FIMW)	74	88	86	82	1,600,000 ac-ft
Clair Engle Lake (Lewiston) (P)	78	83	83	80	2,438,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	62	69	69	50	744,600 ac-ft
NEVADA					
Rye Patch (I)	79	82	97	44	179,100 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	72	75	70	64	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	38	43	14	16	948,600 ac-ft
Salt and Verde River system (IMPR)	73	72	51	38	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	61	62	44	77	352,600 ac-ft
Elephant Butte and Caballo (FIPR)	14	16	9	28	2,539,000 ac-ft

[a] Thousands of kilowatt-hours.

Provisional data; subject to revision

FLOW OF LARGE RIVERS DURING JANUARY 1973

Station number	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1970 (cfs)	January 1973					
				Monthly discharge (cfs)	Percent of median monthly, discharge[1]	Change in discharge from previous month (percent)	Discharge near end of month (cfs)	Discharge near end of month (mgd)	Date
1-0140	St. John River below Fish River at Fort Kent, Maine.	5,690	9,397	4,342	154	-13	5,700	3,680	31
1-3580	Hudson River at Green Island, N.Y.	8,090	12,520	25,450	235	-6	....	....	....
1-4635	Delaware River at Trenton, N.J	6,780	11,360	19,835	194	-21	20,600	13,300	28
1-5705	Susquehanna River at Harrisburg, Pa.	24,100	33,670	45,260	149	-53	68,000	43,900	31
1-6465	Potomac River near Washington, D.C.	11,560	[2]10,640	16,400	143	-54	21,400	13,800	31
2-1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C.	4,810	4,847	9,630	184	-33	13,000	8,400	30
2-1310	Pee Dee River at Peedee, S.C	8,830	9,098	16,700	168	-18	18,900	12,200	29
2-2260	Altamaha River at Doctortown, Ga.	13,600	13,380	28,900	202	+204	34,800	22,500	24
2-3205	Suwannee River at Branford, Fla	7,740	6,775	4,790	115	+59	5,420	3,500	27
2-3580	Apalachicola River at Chattahoochee, Fla.	17,200	21,690	43,300	170	+27	47,900	31,000	30
2-4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala.	15,400	21,700	72,710	251	+92	61,200	39,600	29
2-4895	Pearl River near Bogalusa, La	6,630	8,533	28,610	354	+93	23,400	15,100	25
3-0495	Allegheny River at Natrona, Pa	11,410	[2]18,700	20,410	92	-56	21,200	13,700	29
3-0850	Monongahela River at Braddock, Pa.	7,337	[2]11,950	11,790	64	-71	25,900	16,700	29
3-1930	Kanawha River at Kanawha Falls, W.Va.	8,367	12,370	9,293	60	-68	8,000	5,200	31
3-2345	Scioto River at Higby, Ohio	5,131	4,337	7,059	187	-44	6,360	4,110	26
3-2945	Ohio River at Louisville, Ky[3]	91,170	110,600	125,400	86	-62	118,300	76,500	28
3-3775	Wabash River at Mount Carmel, Ill.	28,600	26,310	55,450	250	+2	46,600	30,100	31
3-4690	French Broad River below Douglas Dam, Tenn.	4,543	[2]6,528	9,010	178	-34	....	....	....
4-0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis.[3]	6,150	4,142	6,400	185	+121	....	....	....
4-2643.31	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y.[4]	299,000	239,100	251,500	112	-7	230,000	148,600	31
5-0825	Red River of the North at Grand Forks, N. Dak.	30,100	2,439	1,180	152	-10	1,100	711	31
5-3300	Minnesota River near Jordan, Minn ..	16,200	3,306	1,855	382	+11	2,900	1,870	31
5-3310	Mississippi River at St. Paul, Minn ...	36,800	[2]10,230	8,172	175	-2	9,140	5,910	30
5-3655	Chippewa River at Chippewa Falls, Wis.	5,600	5,062	4,879	175	+21	....	....	....
5-4070	Wisconsin River at Muscoda, Wis	10,300	8,457	12,061	215	+26	....	....	....
5-4465	Rock River near Joslin, Ill	9,520	5,288	18,590	539	+62	19,500	12,600	30
5-4745	Mississippi River at Keokuk, Iowa ...	119,000	61,210	105,000	317	+109	110,000	71,100	31
5-4905	Des Moines River at Keosauqua, Iowa.	14,038	5,220	10,300	979	+64	17,200	11,100	31
6-2145	Yellowstone River at Billings, Mont.	11,795	6,754	3,139	122	-5	....	....	....
6-9345	Missouri River at Hermann, Mo	528,200	78,480	128,600	390	+101	136,000	87,900	29
7-2890	Mississippi River near Vicksburg, Miss.[5]	1,144,500	552,700	1,105,000	206	+5	1,039,000	671,500	29
9-3150	Green River at Green River, Utah ...	40,600	6,369	2,322	127	+6	....	....	....
9-4025	Colorado River near Grand Canyon, Ariz.	137,800	....	19,630	....	+19	....	....	....
11-4255	Sacramento River at Verona, Calif ...	21,257	18,370	80,020	312	+233	87,400	56,500	26
13-2690	Snake River at Weiser, Idaho	69,200	17,670	23,750	159	+7	21,000	13,600	28
13-3170	Salmon River at White Bird, Idaho ..	13,550	11,060	4,274	102	-10	4,180	2,700	28
13-3425	Clearwater River at Spalding, Idaho ..	9,570	15,320	8,145	124	+3	4,410	2,850	28
14-1057	Columbia River at The Dalles, Oreg.[6]	237,000	194,000	151,000	134	-5	....	....	....
14-1910	Willamette River at Salem, Oreg	7,280	23,370	38,000	72	+15	22,000	14,200	31
15-5155	Tanana River at Nenana, Alaska	27,500	24,040	5,600	85	-5	5,600	3,600	31
8MF005	Fraser River at Hope, British Columbia.	78,300	95,300	35,200	103	-5	33,400	21,600	30

[1]Reference period 1931–60 or 1941–70.

[2]Adjusted.

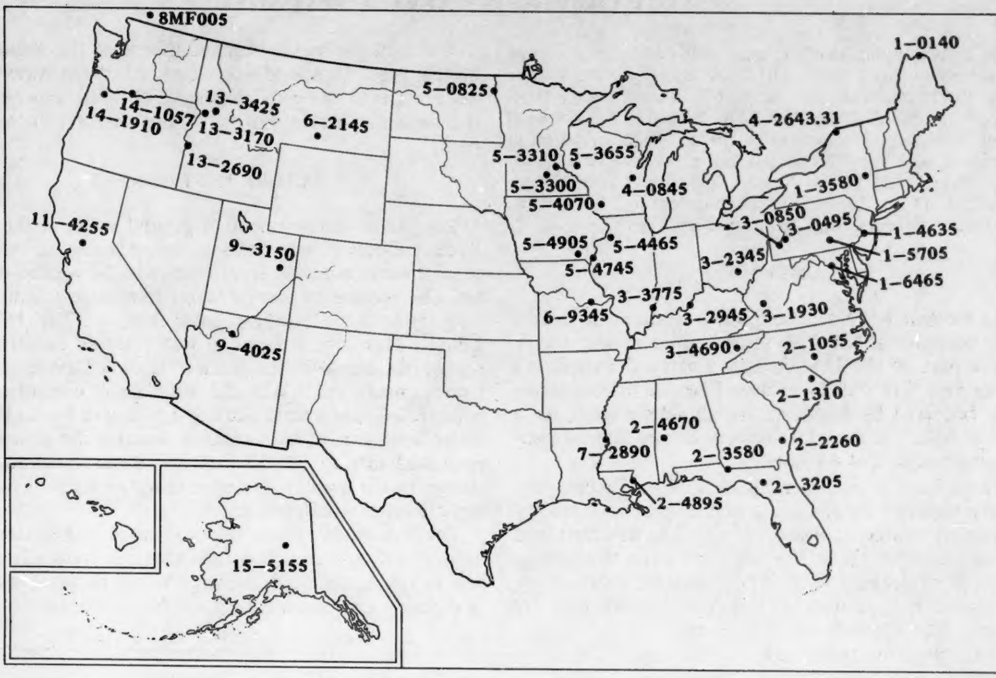
[3]Record furnished by Corps of Engineers.

[4]Record furnished by Buffalo district, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y., when adjusted for storage in Lake St. Lawrence.

[5]Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.

[6]Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.

SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



Location of stream-gaging stations on large rivers listed in table on page 8.

WATER RESOURCES REVIEW **JANUARY 1973**

Cover map shows generalized pattern of streamflow for January based on 22 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for January 1973 is compared with flow for January in the 30-year reference period 1931–60 or 1941–70. Streamflow is considered to be *below normal* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for January is considered to be *above normal* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being within the *normal range.* In the Water Resources Review *normal flow* is defined as the median of the 30 flows of January during the reference period. The normal (median) has been obtained by ranking those 30 flows in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the normal (median).

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the January flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of January. Water level in each key observation well is compared with average level for the end of January determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of December to the end of January.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. In the United States, issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Washington, D.C. 20242.

This issue was prepared by J.C. Kammerer, H.D. Brice, E.W. Coffay, C.R. Murray, and L.C. Fleshmon from reports of the field offices, February 7, 1973.

WATER SUPPLY FOR THE NUCLEAR ROCKET DEVELOPMENT STATION, AT THE U.S. ATOMIC ENERGY COMMISSION'S NEVADA TEST SITE

The accompanying abstract, map, and development recommendations are from the report, *Water supply for the Nuclear Rocket Development Station, at the U.S. Atomic Energy Commission's Nevada Test Site,* by R. A. Young: U.S. Geological Survey Water-Supply Paper 1938, 19 p., 1972; prepared in cooperation with the U.S. Atomic Energy Commission. Water-Supply Paper 1938 (Stock Number 2401-2069) may be purchased for $1.25 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

ABSTRACT

The Nuclear Rocket Development Station, in Jackass Flats, occupies about 123 square miles in the southwestern part of the U.S. Atomic Energy Commission's Nevada Test Site (fig. 1). Jackass Flats, an intermontane valley bordered by highlands on all sides except for a drainage outlet in the southwestern corner, has an average annual rainfall of 4 inches.

Jackass Flats is underlain by alluvium, colluvium, and volcanic rocks of Cenozoic age and, at greater depth, by sedimentary rocks of Paleozoic age. The alluvium and the colluvium lie above the saturated zone throughout nearly all of Jackass Flats. The Paleozoic sedimentary rocks contain limestone and dolomite units that are excellent water producers elsewhere; however, these units are too deep in Jackass Flats to be economic sources of water.

The only important water-producing unit known in the vicinity of the Nuclear Rocket Development Station is a welded-tuff aquifer, the Topopah Spring Member of the Paintbrush Tuff, which receives no significant recharge. This member contains about 500 feet of highly fractured rock underlying an area 11 miles long and 3 miles wide in western Jackass Flats. Permeability of the aquifer is derived mostly from joints and fractures; however, some permeability may be derived from gas bubbles in the upper part of the unit. Transmissivity, obtained from pumping tests, ranges from 68,000 to 488,000 gallons per day per foot. Volume of the saturated part of the aquifer is about 3.5 cubic miles, and the average specific yield probably ranges from 1 to 5 percent.

Water at the Nuclear Rocket Development Station is used for public supply, construction, test-cell coolant, exhaust cooling, and thermal shielding during nuclear reactor and engine testing, and washdown. Present (1967) average consumption of water is 520,000 gallons per day—all supplied by one well. This supply well and a standby well have a production capability of 1.6 million gallons per day—adequate for present needs.

Water in the welded-tuff aquifer is of the sodium bicarbonate type. Dissolved-solids content of the water in Jackass Flats is in the general range 230 milligrams per liter in the western part to 890 milligrams per liter in the eastern part.

FUTURE DEVELOPMENT

Long-term development of ground water at the Nuclear Rocket Development Station depends on the volume of ground water available from storage in the welded-tuff aquifer. The volume of ground water in storage is estimated to range from 5 to 25 billion cubic feet, or 37 to 187 billion gallons. This large amount of water should be sufficient to supply the needs of the Nuclear Rocket Development Station for many years. With the installation of another well, it is expected that a total draft of 1,500 gpm would lower the water level over a wide area, or dewater the aquifer, at an estimated rate of 10–50 feet in 5 years. Assuming no recharge to the aquifer, the ground-water reservoir would be depleted in 50–250 years.

The possibility exists that extensive dewatering of the welded-tuff aquifer will induce recharge from alluvial aquifers to the south. Such recharge would decrease the rate of dewatering and thus prolong the life of the aquifer.

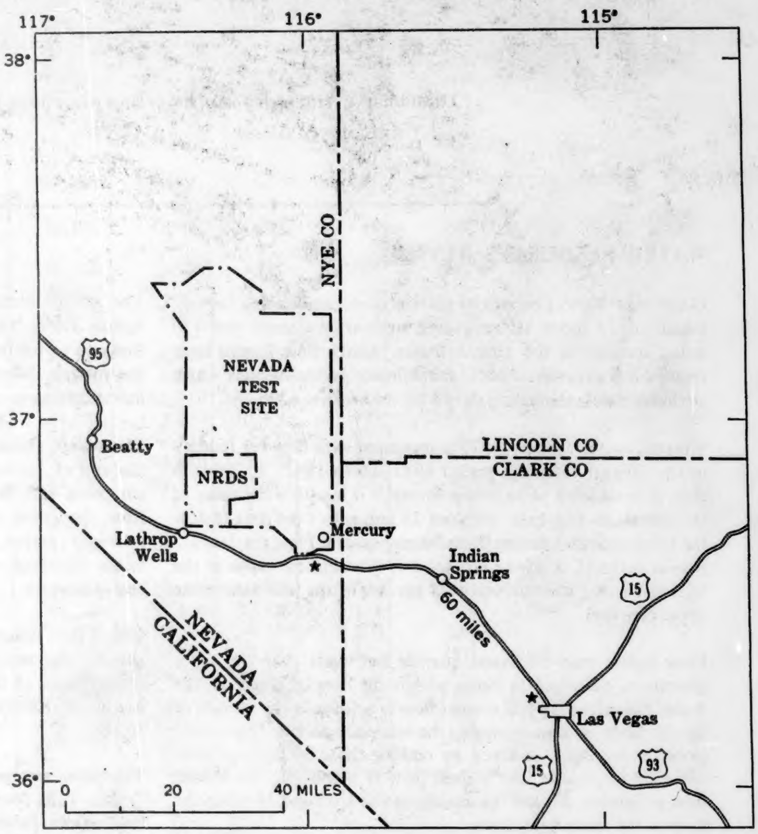


Figure 1.—Location of Nuclear Rocket Development Station (NRDS) and Nevada Test Site.